

CLAIMS

What is claimed is:

1. A threat launch detection system, comprising:

at least one temporal threat detector, each temporal threat detector including a single sensing element operable to sense radiation from various types of short-burn threats that occur within a field of view of the detector and to generate a detection signal in response to the sensed radiation; and

a processing circuit coupled to each temporal threat detector and operable to analyze the detection signal from each temporal threat detector as a function of time to detect the occurrence of a short-burn threat within the field of view of any of the temporal threat detectors.

2. The threat launch detection system of claim 1 wherein each temporal threat detector comprises a prism-coupled compound parabolic concentrator.

3. The threat launch detection system of claim 2 wherein the prism-coupled compound parabolic concentrator includes a prism formed from a material selected from the group consisting of silicon, germanium, plastic, and high-index of refraction glass.

4. The threat launch detection system of claim 2 wherein the prism-coupled compound parabolic concentrator has a field of view of approximately ninety degrees.

5. The threat launch detection system of claim 1 wherein each temporal threat detector comprises:

optics operable to receive incident radiation and to focus this radiation in a focal plane;

single sensor element positioned relative to the optics to receive radiation passing through optics;

a sensor array positioned in the focal plane to receive focused radiation from the optics.

6. The threat launch detection system of claim 5 wherein the single element sensor is positioned adjoining the sensor array between the sensor array and the optics.

1                   7.     The threat launch detection system of claim 5 wherein the  
2     single element sensor is positioned between the sensor array and the optics at a  
3     distance that is less than a distance of the focal plane from the optics.

4                   8.     The threat launch detection system of claim 1 wherein the  
5     processing circuit includes a temporal template for each short-burn threat to be  
6     detected, and wherein the processing circuit compares each detection signal to  
7     each of the templates and determines a short-burn threat exists when the  
8     detection signal approximately matches one of the temporal templates.

9                   9.     A threat launch detection system, comprising:  
10                   a plurality of temporal threat detectors, each temporal threat  
11     detector including a single sensing element operable to sense radiation from  
12     various types of short-burn threats that occur within a field of view of the detector  
13     and to generate a detection signal in response to the sensed radiation;

14                   a plurality of bias and amplification circuits, each bias and  
15     amplification circuit coupled to a corresponding temporal threat detector and  
16     operable to bias and amplify the corresponding detection signal to develop a  
17     conditioned detection signal;

18                   a multiplexing analog-to-digital converter coupled to each of the  
19     bias and amplification circuits to receive the corresponding conditioned detection  
20     signal, the converter operable to sequentially digitize each of the conditioned  
21     detection signals;

22                   a plurality of sensor arrays, each sensor array operable to capture  
23     images of threats within a field of view of the array;

24                   a fusion processing circuit coupled to the analog-to-digital  
25     converter and the sensor arrays, the fusion processing circuit analyze the  
26     detection signals from each temporal threat detector as a function of time to  
27     detect the occurrence of a short-burn threat within the field of view of any of the  
28     temporal threat detectors and thereafter operable to process images from one or  
29     more of the sensor arrays having fields of view that overlap the field of view of  
30     the temporal threat detector that sensed the short-burn threat, the circuit  
31     processing the images to more precisely identify a location of the detected  
32     threat; and

1                   a countermeasure controller coupled to the fusion processing  
2 circuit, the controller operable to implement countermeasures in response to the  
3 location and type of detected threat.

4                   10.    The threat launch detection system of claim 9 wherein the  
5 fusion processing circuit is further operable in response to detecting a short-burn  
6 threat to assign a timestamp, type indicator, and identifier to the detected threat.

7                   11.    The threat launch detection system of claim 10 wherein the  
8 fusion processing circuit is operable to process images from one or more of the  
9 sensor arrays by comparing two images from the appropriate sensor array that  
10 were captured nearest in time to the timestamp parameter assigned to the  
11 detected threat.

12                  12.    The threat launch detection system of claim 9 wherein each  
13 temporal threat detector comprises a prism-coupled compound parabolic  
14 concentrator.

15                  13.    The threat launch detection system of claim 12 wherein the  
16 prism-coupled compound parabolic concentrator includes a prism formed from a  
17 material selected from the group consisting of silicon, germanium, plastic, and  
18 high-index of refraction glass.

19                  14.    The threat launch detection system of claim 9,  
20 wherein each temporal threat detector comprises:  
21                   optics operable to receive incident radiation and to focus this  
22 radiation in a focal plane;  
23                   single sensor element positioned relative to the optics to  
24 receive radiation passing through optics;  
25                   one of the sensor arrays positioned in the focal plane to  
26 receive focused radiation from the optics; and

27                  wherein the fusion processing circuit further includes a staring  
28 array processor for processing the images captured from the sensor arrays.

29                  15.    The threat launch detection system of claim 14 wherein the  
30 single element sensor is positioned either adjoining the sensor array between  
31 the sensor array and the optics or between the sensor array and the optics at a  
32 distance that is less than a distance of the focal plane from the optics.

33                  16.    A method of detecting short-burn threats, comprising:

1                   sensing radiation within a field of view;  
2                   generating a single detection signal in response to the sensed  
3 radiation; and  
4                   analyzing the detection signal as a function of time; and  
5                   detecting from the analysis whether the signal indicates a short-  
6 burn threat has occurred within the field of view.

7                   17. The method of claim 16 wherein analyzing the detection  
8 signal as a function of time comprises:  
9                   comparing the detection signal to a plurality of temporal templates,  
10 each temporal template being associated with a particular type of short-burn  
11 threat; and  
12                   determining a short-burn threat exists when the detection signal  
13 approximately matches one of the temporal templates.

14                   18. The method of claim 16 further comprising:  
15                   capturing images of the field of view being sensed; and  
16                   when the operation of determining indicates a short-burn threat  
17 exists, analyzing the captured images to identify more specifically a location of  
18 the threat.

19                   19. The method of claim 16 further comprising taking  
20 countermeasures in response to detecting a short-burn threat.

21                   20. The method of claim 16 wherein the types of short-burn  
22 threats detecting include tank shells and rocket-propelled grenades.